stantly. I then examine it under a one-inch objective, to determine whether the exact point where the blue and the red remain distinct has been reached. If the blue has not occupied all the softer cells, I take another section, and put it through the same process, counting twelve, and so on, until the proper point is reached; or on the other hand, decreasing the count, if the blue has infringed upon the red in the more dense tissue. Having thus determined the count for the sections of that particular material, I pass the remainder of my sections through the blue into the alcohol, merely counting off the immersion of each section. I then place the sections for a few moments in absolute alcohol, which seems to fix the colors, then through oil of cloves into benzole, and mount in damar and benzole. It is sometimes advisable, with delicate tissues, to merely rinse off the blue in 95 per cent. alcohol and fix the colors in absolute alcohol, but every operator will learn the minor details for himself in the manipulation.

Of course, with the "rule of thumb" method of counting off the time, slight variations will occur, which will mar the beauty of the finished product; besides which minute differences in the thickness of the section will affect the result, and even a distance of a quarter of an inch in the same stem will make a difference in the density of the tissue, which will be obvious in the sharpness of the colors under the objective. So that the operator should not be disappointed if, out of a dozen slides, only four should be worth preserving. The others can go into the borax pot to be cleaned for another operation. However, the beauty of those which do pass inspection, will amply repay for the labor on the spoiled ones. I have perhaps been needlessly minute in the description of the process I have employed, but I have been so often hampered for the lack of minuteness in descriptions of processes by others, which I have been endeavoring to carry out, that I deem it better to err upon the safe side, even at the risk of being considered dry or prosy.

One word as to the use of eosin. I was attracted to it by its exquisite purity of color under transmitted light, and its perfect transparency. I found that sections preserved in its solution, always retained their transparency, and did not become clogged or thick with color, so that when taken out after months of immersion, the most dense cells were no deeper in color than the solution itself So far as regards its hold upon the tissues, it is as strong as roseine, or any of the heavier colors I have ever tried. I cannot testify as to its permanence, but I have some slides that were prepared over a year ago, that appear to be as bright and pure, as when they were mounted. Contrary to the experience of some others, I have not found that the benzole has any bleaching effect, and I have used it with damar, in preference to the usual balsam. Slides prepared with damar, however, should have a thick ring of varnish around them as the damar is brittle, and should not be trusted alone, to hold the covering glass.—W. *in American Microscopical Journal.*

Does Chlorophyll Decompose Carbonic Acid?—The recent memoirs of Pringsheim (Untersuchungen uber das Chlorophyll) sug-

gest very serious doubts as to the correctness of an inference which has crept, without the explicit consent of botanical physiologists, into the position of a fundamental doctrine of biological science. Recent articles and discussions make it desirable to examine critically, the claims which the inference alluded to has on our adhesion.

The inference in question is this, that the substance known as chlorophyll has the property of decomposing carbo nic acid so as to fix the carbon and liberate a portion of the oxygen of that acid, when in the presence of sunlight. Accordingly it has been said that "Chlorophyll is the hand wherewith the organic world lays hold of the carbon of the inorganic world" Vegetable physiologists are, however, careful not to commit themselves to such an assertion with regard to chlorophyll itself. The chlorophyll grains, or corpuscles, are particles of protoplasm impregnated with chlorophyll much in the same way as the blood corpuscles and other tissues of animals, are impregnated with hæmoglobin. It is one thing to attribute the decomposition of carbonic acid to "cells containing chlorophyll" or even to "chlorophyll corpuscles," and another thing to pass from such a wide statement to the definite ascription of the CO_2-decomposing property to the green colored substance chlorophyll.

It is perfectly true that by the method of concomitant variation, we are led to a conclusion favorable to the *importance* of chlorophyll in this function. It is only by plants (or animals) containing chlorophyll, and only in those parts of the plants containing it that CO_2 is decomposed and oxygen liberated. Further, it appears that whenever chlorophyll is present *in a living organism* (even an animal) exposed to sunlight, the decomposition of CO_2 takes place. But while we are there justified in *connecting* chlorophyll with the decomposition in question, any conclusion as to its sole efficiency, and accordingly any notion of a specific chemical activity on its part, is forbidden by two important facts: firstly, that living protoplasm is always present in intimate association with the chlorophyll when the decomposition of CO_2 is effected (forming the bulk of the chlorophyll corpuscle); and secondly, that chlorophyll extracted from the chlorophyll-corpuscle and put to the test *in the absence of protoplasm* has hitherto not been shown to possess the power of the specific decom position sometimes attributed to it.

Very usually blood red and leaf green are placed side by side as complementary, not only in color but also in function, the one active in oxidation and the special property of the animal, the other, active in deoxidation and the special property of the plant. Nevertheless, a most important fact is true of hæmoglobin which we have not ground for asserting with regard to chlorophyll, namely, that it can be extracted from the albuminoid substance with which it is associated, and then, when in a pure crystalline state can be made to exhibit its peculiar property of combining with oxygen, and again liberating that oxygen just as it does in living tissues. On the other hand the peculiar property which has been inferred for chlorophyll, namely, that of seizing the group CO from CO_2 and liberating O under the influence of sunlight, ceases altogether [as far as we know] when chlorophyll is

detached from the living protoplasm of an organism, and no effect of any kind can be produced upon CO_2 by its agency when thus isolated.

It may be urged that the chlorophyll when extracted from the chlorophyll-grain is chemically altered by the solvent (alcohol or ether) used. But the solution obtained by appropriate treatment of green leaves gives precisely the same absorption-bands as does the green substance in the plant (the whole series being moved a very little to the blue end according to the known law that absorption bands travel in that direction when a less dense solvent is substituted for a more dense one).

It cannot, however, be stated that a negative has been directly proved with regard to the supposed CO_2-decomposing property of chlorophyll. It is possible that chlorophyll when extracted by solvents from the chlorophyll corpuscles may yet be shown to possess that property. The solvents themselves may, so long as they are present, exert an inhibitory effect. Whilst ether and alcohol may do so, it is possible that vegetable fats may be more propitious, or that some other solvents may be found more closely resembling the natural solvent or the chlorophyll-corpuscle than those at present known.

Apart from the absence of sufficient evidence to warrant the assumption that chlorophyll has a specific chemical action on carbonic acid in the presence of sunlight, three facts render the supposition improbable :

1. If chlorophyll were the active agent in CO_2-decomposition, we should expect the rays absorbed by chlorophyll to be those most efficient in promoting such decomposition. Such, it has been shown by Sachs and others, is *not* the case.

2 It may well be that chlorophyll has other work to do in its relation to the specific chemical activities promoted in protoplasm by the incidence of the luminous rays. Prof. Pringsheim suggests that the true function of chlorophyll is by its general absorbent action on light to protect the protoplasm of the cell from excessive oxidation, and especially to protect that of the chlorophyll corpuscles. Oxidation being thus nearly or entirely arrested in these corpuscles, whilst proceeding in a lessened degree in the general protoplasm of the cell, the protoplasm of the chlorophyll corpuscles is at liberty *under the influence of those rays of light which are allowed to pass by the chlorophyll* (the very reverse of former suppositions on the subject) to decompose CO_2 and synthesize the elements of starch (or of hypochlorin).

3. That so special an activity as the decomposition of CO_2 and the synthesis of the elements of starch is due to protoplasm and not to the chemically simple (comparatively) chlorophyll is probable on *a priori* grounds.

If this green pigment is really something more than a screen for protoplasm, its character must be established by direct demonstration of its capabilities. The facts, as at present in evidence, look very much as though chlorophyll had been assigned a position of unmerited dignity.—E. Ray Lankester, F.R.S. *in Nature*, April 15.

Some Big Trees of Indiana.—In Case's *Botanical Index* for

April we find the following record of some large trees growing in Indiana :

Chestnut.—In Jackson county are to be found the largest chestnut trees in the State. They are veritable giants, located about three miles southeast of Seymour. One of these measures 22 feet in circumference, two feet above the ground. The height to the first limb is about 70 feet.

Sassafras.—The Sassafras attains a remarkable size on the Lower Wabash One of of these, one mile and a half west of Springfield, the old county seat of Posey, is full three feet in diameter, and for more than 60 feet, clear of limbs and knots. Its height, in full, is 85 feet.

Catalpa.—In this same region and along the Wabash, the Catalpa grows tall and slender, and in great abundance. It is used for both fence rails and posts, especially for the latter, and for durability stands next to black locust.

Sycamore.—The giant tree of Indiana in all probability, is a Sycamore in the White river bottom, not far from Worthington. It is said to be 48 feet in circumference, and has a solid trunk. At a height of 25 feet it branches into three or four limbs, one of which must be more than five feet in diameter. The tree is not quite round, but is still quite regular.

A Natural Botanic Garden.—I do not believe that any college grounds in the country, of equal extent, can surpass those of Wabash College, Indiana, in the display of native plants. A large class began active operations in the botanical laboratory as soon as the first flowers came. They have worked unremittingly ever since, some of them several hours a day ; but the grounds are far from being exhausted, even of the simpler phænogamous plants. The plants are well distributed through the families and we need no better garden for our work than the one growing without care under our feet. All the Hydrophyllums are there, and Phacelias, Scilla, three or four Trilliums, five or six species of Ranunculus, several Violets, Geraniums. Erythroniums, Isopyrum, Stylophorum, the early Composites, and so on till we could make a very respectable list of spring flowers.—J. M. C.

Some Plants of Franklin Co., Ky.—*Ptelea trifoliata*, L., is rare, but one specimen having been seen. *Rhamnus lanceolatus*, Pursh, is common along the limestone cliffs. *Polygala Senega*, L., var. *latifolia*, T. & G., is the only representative of this genus which I have met with, and it is common.

Medicago lupulina, L., is well established in many places along road sides.

Vicia Caroliniana, Walt., was met with only once in rich limestone soil.

Phaseolus diversifolius, Pers., is rare on dry hillsides.

Desmanthus brachylobus, Benth., was only found growing in cultivated grounds. Two species of *Spiræa* were met with, viz : *S.*